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Publication date:
2017

Document Version
Publisher's PDF, also known as Version of record

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Citation (APA):
Valverde Pérez, B., Wágner, D. S., Steidl, M., Villez, K., & Plósz, B. G. (2017). *In-situ UV-Vis Probe to Monitor Algal Photobioreactors Treating Municipal Wastewater*. Poster session presented at 12th IWA Specialized Conference on Instrumentation, Control and Automation, Quebec City, Canada.

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In-situ UV-Vis Probe to Monitor Algal Photobioreactors Treating Municipal Wastewater

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1. INTRODUCTION

End use of green microalgae [1]:

- Biofuels
- Organic fertilizers
- High value added products (e.g. pigments)

Unsustainable if not coupled with used water treatment

Monitoring systems for photobioreactors [2]:

- Usually focus on biomass or pH
- Mostly validated with synthetic media

3. OBJECTIVE

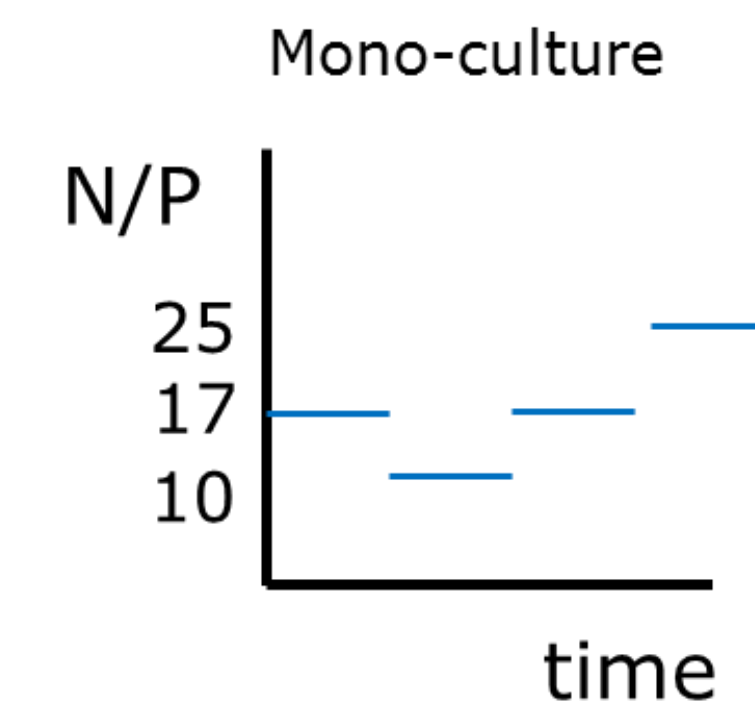
Validate a **UV-Vis sensor** as a suitable monitoring tool for **algal photobioreactors** treating **municipal used water** for resource recovery

2. MATERIALS AND METHODS

EXPERIMENTAL DESIGN

Two lab-scale photobioreactors [3]:

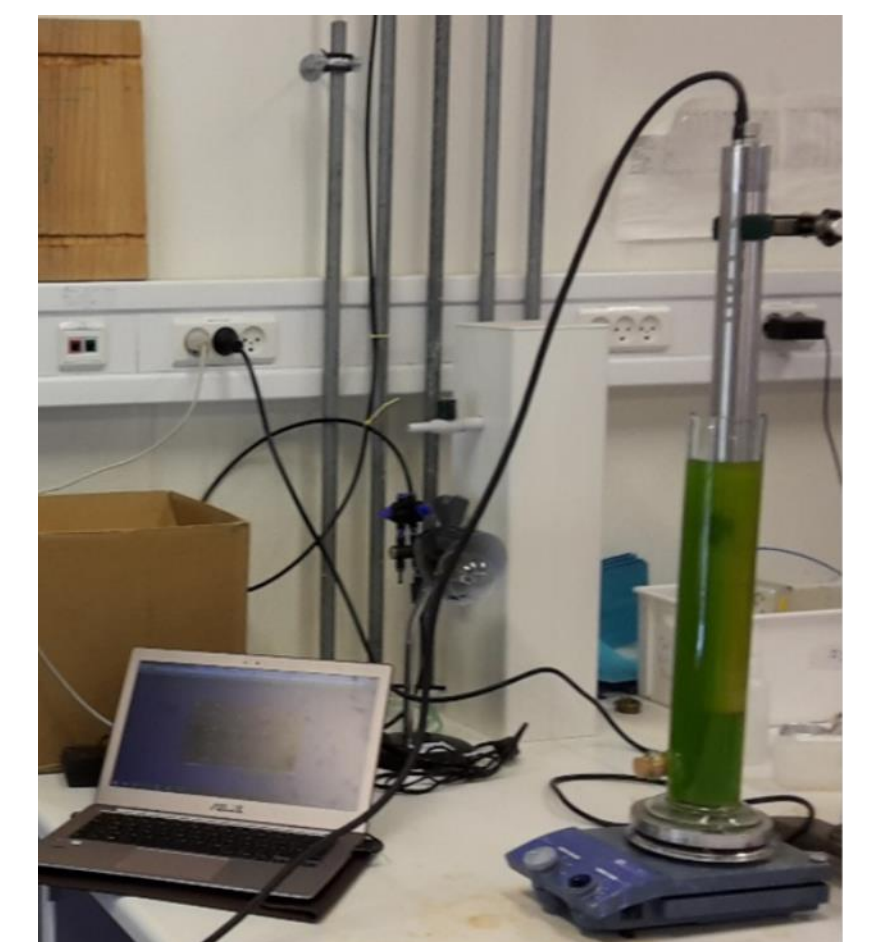
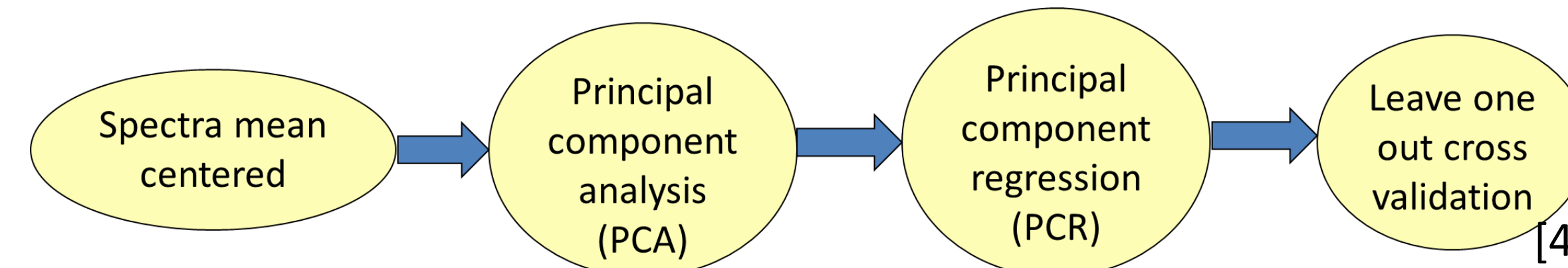
- 1.4 L reactor
- Hydraulic retention time of 3.5 days
- Fed with treated municipal used water
 - Variability in nutrient load



ANALYTICAL METHODS

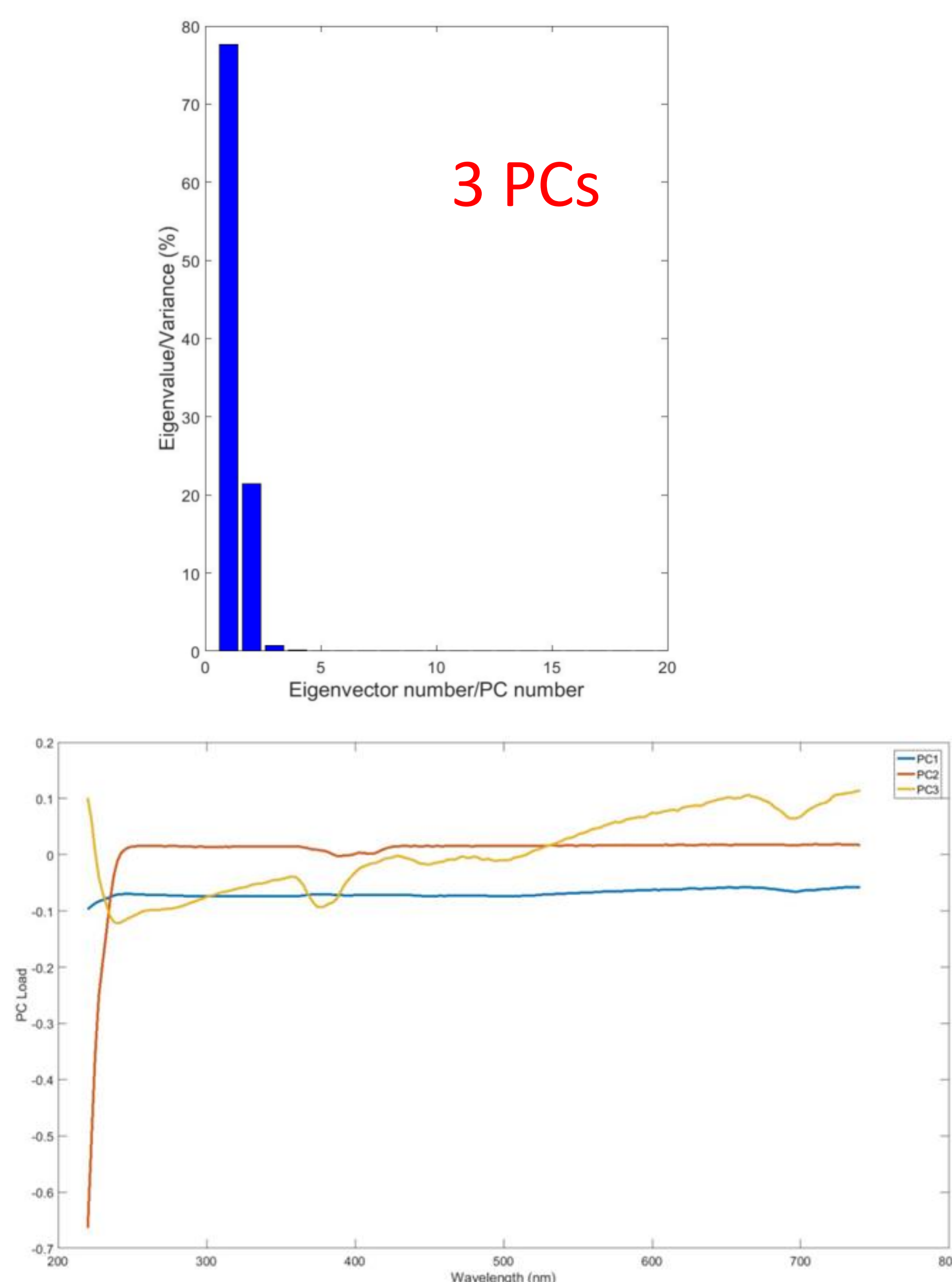
Variables monitored:

- Nitrate
- Total suspended solids
- Total chlorophyll



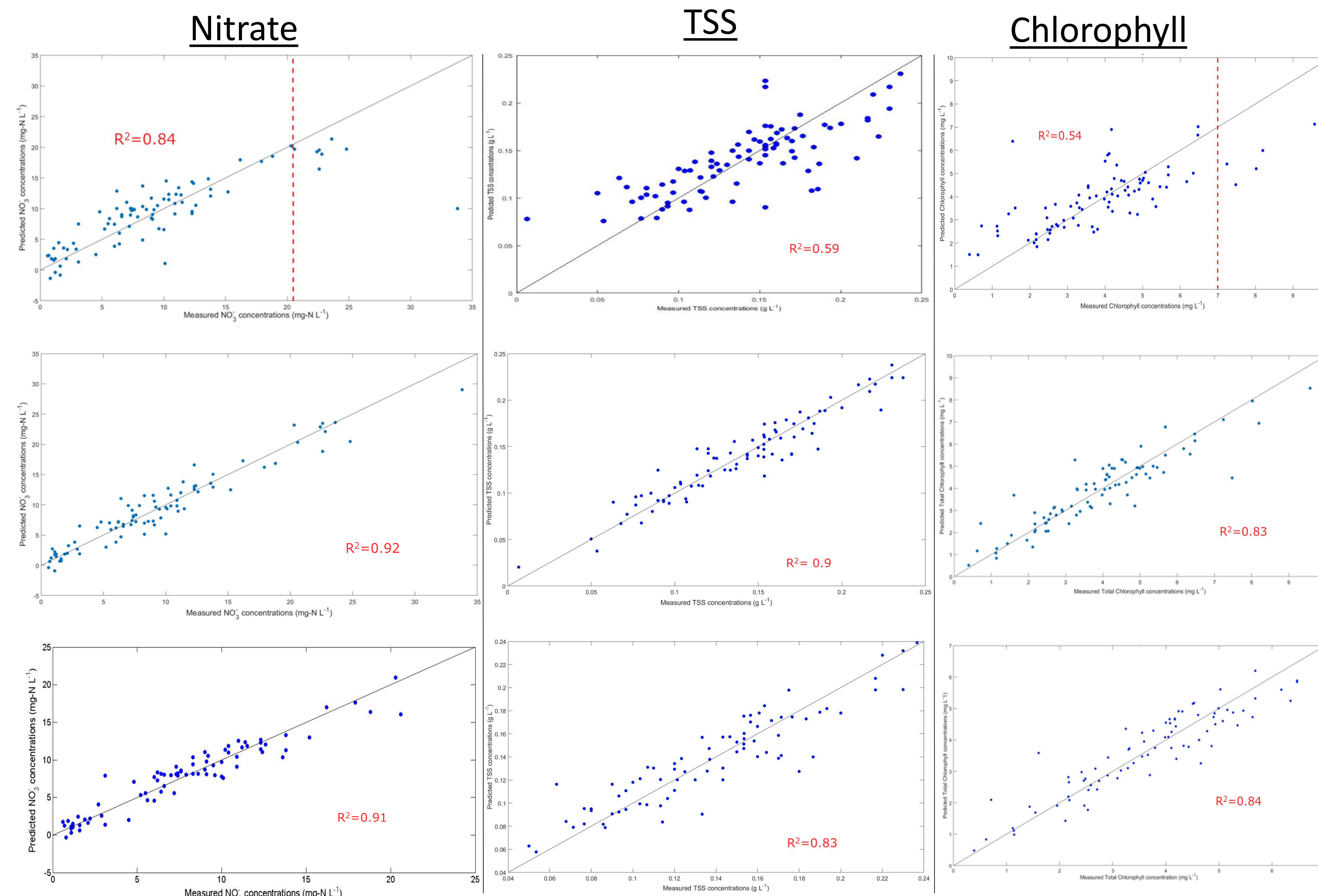
4. RESULTS AND DISCUSSION

Principal component analysis



- **PC1** relates mainly to variability on **TSS** and **chlorophyll**
- **PC2** relates mainly to variability on **nitrate**

Principal component regression



- **First row:** models based on 3 first PCs
 - Only accurate for nitrate
- **Second row:** models based on the optimal model suggested by the leave one out cross validation method
 - Accurate, but over parametrized for TSS (40 PCs) and chlorophyll (27 PCs)
- **Third row:** models based on data after outlier removal (TSS) or saturation data removal (nitrate and chlorophyll)
 - **Nitrate:** only 10 PCs give comparable results as optimal after saturation removal
 - **TSS:** only 10 PCs give comparable results as optimal after outlier removal
 - **Chlorophyll:** only 24 PCs give comparable results after saturation removal

ACKNOWLEDGEMENTS



References:

- [1] Cai and Park. *Renewable Sustainable Energy Reviews* 19 (2013): 360-369.
- [2] Havlik et al. *Trends in Biotechnology* 31 (2013): 406-414.
- [3] Wágner. *Used water resource recovery using green microalgae*. PhD thesis DTU Environment
- [4] Masic et al. *Water Research* 85 (2015): 244-254.

